

## Software tool for xenon gamma-ray spectrometer control

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**Abstract.** Software tool «Acquisition and processing of gamma-ray spectra" for xenon gamma-ray spectrometers control was developed. It supports the multi-windows interface. Software tool has the possibilities for acquisition of gamma-ray spectra from xenon gamma-ray detector via USB or RS-485 interfaces, directly or via TCP-IP protocol, energy calibration of gamma-ray spectra, saving gamma-ray spectra on a disk.

### 1. Introduction

Software tool «Acquisition and processing of gamma-ray spectra" was designed to control the operation of xenon gamma-ray spectrometer [1] by computer, using special unit of digital electronics [2] for signal processing as emulator of the analyzer.

Software tool was developed in the CodeGear™ RAD Studio 2007 [3] using the programming language DELPHI. Software tool is a set of interactive windows which allow acquisition, saving to disk and reading from disk gamma-ray spectra and spectra of background, visualizing them, carrying out an energy calibration and processing of gamma-ray spectra. This article will review the software tool functions for management of gamma-ray spectrometer.

### 2. Software tool as emulator of the analyzer

Software tool «Acquisition and processing of gamma-ray spectra" is composed of a main window, window of spectra and auxiliaries windows for determine processing and analyzing options of the spectrum. The software tool supports multiple-window acquisition, view and processing of the spectra.

Software tool has the following functions as emulator of the analyzer:

- selection of an interface for data transfer from xenon gamma-ray spectrometer to a computer – USB or COM;
- setting a threshold for detecting a signal from the xenon gamma-ray spectrometer;
- enabling and disabling charge sensitive amplifier of xenon gamma-ray spectrometer;
- start, stop, pause, resume commands for spectra acquisition;
- autosave spectra at scheduled intervals;
- stop command can be done interactively or automatically at predetermined real-time or live-time;
- automatic acquisition the predetermined number of spectra;
- control of xenon gamma-ray spectrometer through the connection Socket Server-Client; the external program Socket-Client controls the start, stop, time of acquisition and processing the



spectrums analysis by means of the relevant commands transferred to the software tool which runs in the mode of Socket-server;

- display on the screen process of spectrum acquisition and its parameters in real time;
- saving and loading spectra from disk PC.

### 3. Control of spectrum acquisition

#### 3.1. Spectrum acquisition

To activate a new spectrum it is necessary to call the command "Acquisition the new spectrum" through the "File" main menu or the corresponding toolbar button. It opens a child window, intended to acquisition the gamma spectrum using xenon gamma-ray spectrometer (figure 1).

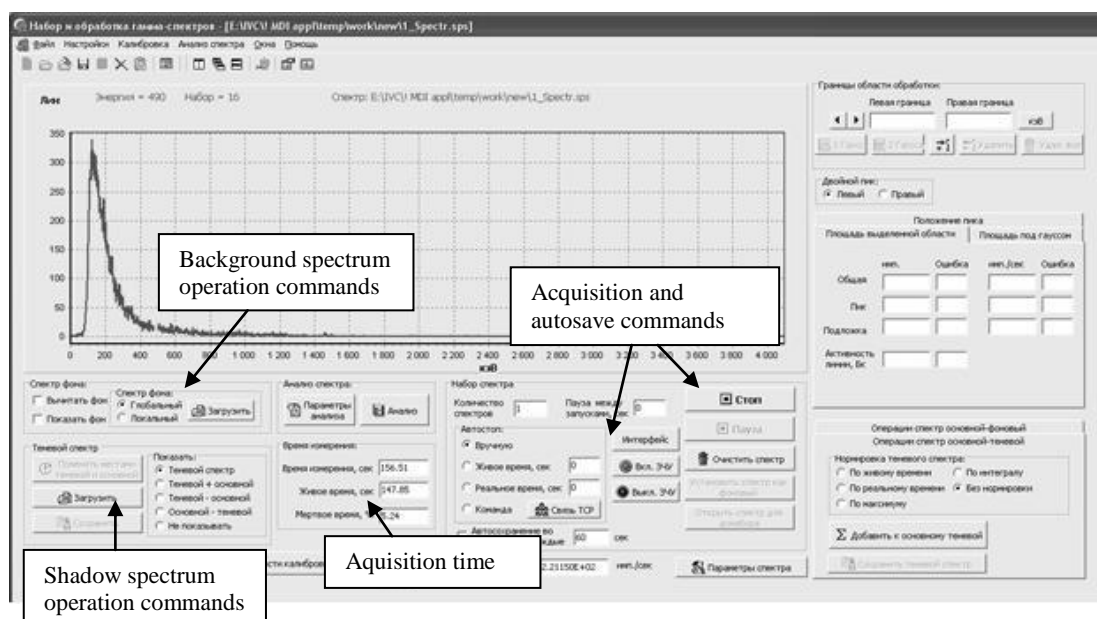


Figure 1. Main window of software.

Before the start of acquisition it is possible to select the data interface using window "Select the port for data transmission» (figure 2), which allows you to choose USB or COM-port interface.

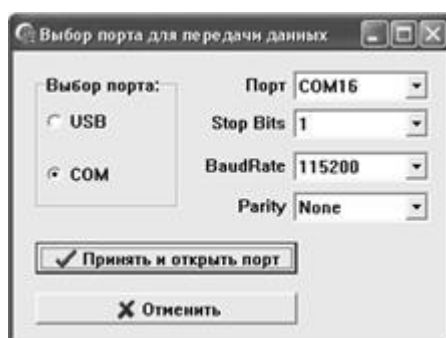


Figure 2. Select the port for data transmission.

If a connection is available, the port is opened for communication with xenon gamma-ray spectrometer. In the case of a successful connection to xenon gamma-ray spectrometer button

"Acquisition" becomes available to press. To manage a spectrum acquisition from xenon gamma-ray spectrometer use the following commands (see main window in figure 1):

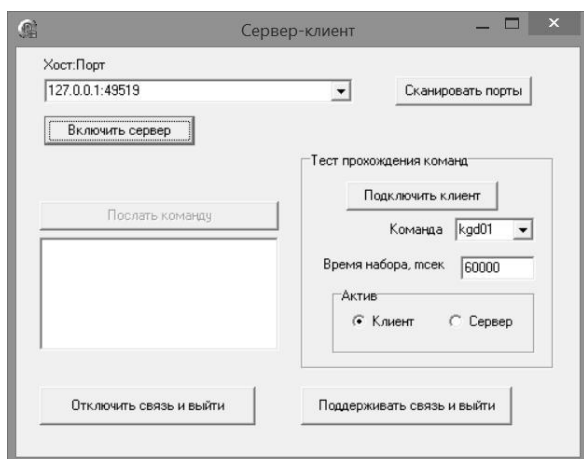
- « Acquisition » – start a new spectra acquisition after clear all data from the previous spectra,
- «Stop» – stop of acquisition;
- «Pause" – pause of acquisition;
- «Resume" – to resume (continue) acquisition after pause;
- «Clear spectrum" – reset spectrum and all associated data;
- «Open spectrum for acquisition" – lets to download the available spectrum from a file using the standard dialog box and continue its acquisition;
- «Set the spectrum to background" – a command is only available when the acquisition is stopped and allows to declare the present spectrum as the spectrum of the background and to use it as a background during the future work;
- "Autosave during an acquisition" processes automatic saving spectrum into the file through every user-specified time interval;
- "Autostop" allows choosing the stop options of acquisition: by hand, at the specified of real-time or live-time and from external Socket-client commands. In the latter case the software tool works in a mode Socket-server.

### 3.2. The Communications Socket Server-Client in the mode of to an external commands

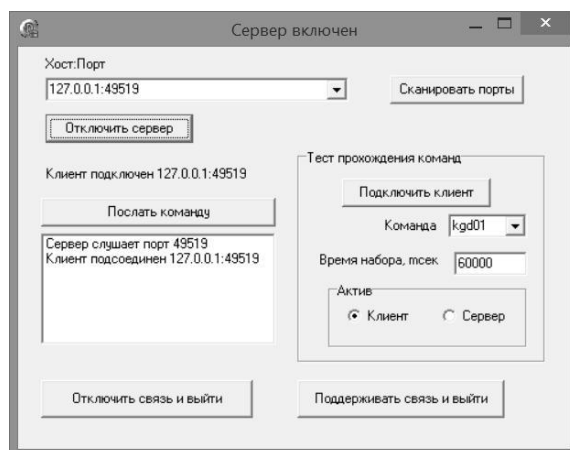
The connection socket server-client must be established for using external commands. To do this, one should click the button "Connection", open window "Client-Server» (figure 3) and select the host address and port through for the connection server-client.

Figure 4 shows the connection installed. Following commands are available for xenon gamma-ray spectrometer:

- kgd01 – start of acquisition,
- kgd02 – stop of acquisition,
- kgd03 – request result of spectra analysis by the total activity exceeding a predetermined threshold value. The answer is sent automatically.
- kgd04:xxx – set time of acquisition, where xxx – time of acquisition in milliseconds.



**Figure 3.** Window of connection Socket Client-Server. Waiting for connection.



**Figure 4.** Window of connection Socket Client-Server. The server is turned on; the client is connected to the server.

The software tool also allows determining the name of the spectrum and comments, the data about the type of radioactive source. The user can send commands into block of digital electronics xenon

gamma-ray spectrometer: write detection threshold, set rejection and integration time of the signal, enable/disable the charge sensitive amplifier detector.

During the acquisition, it is possible to carry out the energy calibration of the spectra. To do this, it is necessary to enter the value of the corresponding channel energy of the two peaks. Calibration parameters can be as loaded from file as saved to it. After calibration, the spectrum can be redrawing in keV values.

#### 4. Conclusion

Software tool «Acquisition and processing of gamma-ray spectra" was designed to control the operation of xenon gamma-ray spectrometer by computer using a special unit of digital electronics for signal processing as emulator of the analyzer via USB or RS-485 interfaces, directly or via TCP-IP protocol.

Software tool is composed of a main window, window of spectra and auxiliary windows for determining processing and analyzing options of a spectrum and supports multiple-window acquisition, view and processing of the spectra.

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#### References

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